

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
31 March 2005 (31.03.2005)

PCT

(10) International Publication Number
WO 2005/028962 A1

(51) International Patent Classification⁷: F24C 7/00,
F21S 10/04

(21) International Application Number:
PCT/GB2004/004042

(22) International Filing Date:
23 September 2004 (23.09.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0322190.0 23 September 2003 (23.09.2003) GB
0326425.6 12 November 2003 (12.11.2003) GB

(71) Applicant (for all designated States except US): FOCAL
POINT MANUFACTURING COMPANY LIMITED
[GB/GB]; 436 Hillington Road, Hillington Industrial
Estate, Glasgow G52 4BL (GB).

(72) Inventors; and

(75) Inventors/Applicants (for US only): McNISH, John
[GB/GB]; Focal Point Manufacturing Company Limited,
436 Hillington Road, Hillington Industrial Estate, Glasgow

G52 4BL (GB). FOWLIE, Douglas [GB/GB]; Focal Point
Manufacturing Company Limited, 436 Hillington Road,
Hillington Industrial Estate, Glasgow G52 4BL (GB).
KINNIBURGH, Robin; Focal Point Manufacturing Com-
pany Limited, 436 Hillington Road, Hillington Industrial
Estate, Glasgow G52 4BL (GB).

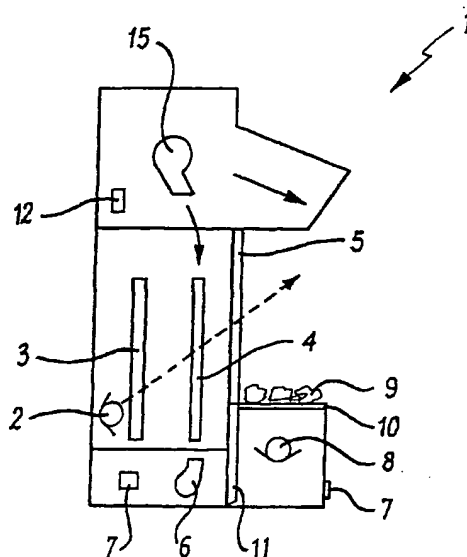
(74) Agent: KENNEDYS PATENT AGENCY LIMITED;
Floor 5, Queens House, 29 St. Vincent Place, Glasgow G1
2DT (GB).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,
MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG,
PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,
ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,

[Continued on next page]

(54) Title: APPARATUS FOR SIMULATING FLAMES



(57) Abstract: Apparatus for producing a non-repeat or random flame effect comprising a light source (2) from which emitted light beams can be viewed in use through a diffuser screen (5), wherein a first flame template (3) and a second randomly moveable flame template (4) are disposed between the light source and the diffuser screen. The first flame template is stationary having transparent and opaque sections wherein the sections show a drawing or photograph of a flame. The second flame template has flexible elongate members (13) which flutter in an air current. A flame effect fire is also described wherein the flame simulating apparatus is associated with a first light source and the fuel bed (9) is associated with an independently operated second light source (8).

WO 2005/028962 A1



GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

Published:

— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

APPARATUS FOR SIMULATING FLAMES

This invention relates to electric fireplaces, and in particular those that incorporate flame simulation apparatus.

For several years now, electric heaters have been designed and manufactured typically for use in domestic environments, and which incorporate apparatus for simulating the appearance of an open log or coal fire. In this endeavour, it is desirable to provide a visually pleasing and aesthetic appearance, with a flame effect that is natural and mimics that of a true flame.

Flame simulating electric fires generally require a reflective means suited to reflect light omitted from an electric light source onto a projected surface, which in most fires of this type is visible through a front plate diffuser, or in some cases, is the diffuser plate itself. The diffuser typically lies between an artificial fuel bed of coal, rock or the like which may also be illuminated by light from the light source.

It is recognised in the present invention that the type and location of the light source within the apparatus may be compromised by its requirement to both illuminate the flame effect while also being required to illuminate the artificial fuel bed. It is further recognised that there may be times when a user wishes only to illuminate the fuel bed, for example, without the flame simulation to be present.

It will be appreciated by those skilled in the art that in order to simulate natural flames, there must be a constantly changing image of the flames as the flames appear to "flicker" and vary in size and shape. In the past, attempts to achieve this visual effect have been pursued in various ways. For example, European Patent Application No EP 1,225,389 in the name of Kal-Fire teaches of a transparent plate located between a light source and projecting surface. The transparent plate has been rolled into the form of a drum and is provided with a pattern of protrusions that are used to reflect emitted light onto the projecting surface. The transparent plate is rotated about a shaft between the light source and the projecting surface.

While such a design allows for a variance in the shape, size and even intensity of the simulated flame, it inevitably leads to a repetition of the visual pattern. It will be understood that as the drum rotates, the projected image is repeated every 360° of rotation.

Thus, in order to provide a more natural and realistic flame appearance, an object of the present invention is

to provide a non-repeating or random series of images for the said flame simulation.

A known method for producing the randomly sized and shaped flames incorporates the use of ribbons or the like. These ribbons are acted upon by a fan which causes them to flutter in a similar manner to a flickering flame in a natural fire. Such ribbons are taught in various prior published documents, including European Patent No. EP 0897514B in the name Dimplex North America Limited.

In all of the prior art, the ribbons are made of a generally reflective material and are adapted to reflect the emitted light such that the ribbons themselves are presented as the simulated flames to a viewer. However, one disadvantage of this design is that frequently it is possible to determine the outline or perimeter of such ribbons. Therefore, the illumination of the ribbons for subsequent reflection to a viewer serves only to increase the visibility of their true identity and thus detracts from the natural and authentic appearance of the fire.

According to a first aspect of the present invention, there is provided apparatus for producing a non-repeat or random flame effect comprising a light source emitting light beams and a diffuser screen through which the light beams are viewed, wherein a first flame template and a second randomly moveable flame template are disposed between the light source and the diffuser screen.

The first flame template may be a generally planar sheet material comprising of opaque portions and transparent

portions. Alternatively, it may be cylindrical or hexagonal.

Typically, the first flame template will be stationary.

The transparent portions of the first flame template may be made of a Perspex or other transparent material. Alternatively, there may be cut out portions in the otherwise opaque first flame template.

Preferably, the transparent portions of the first flame template is a still photograph of a flame.

Optionally, the first flame template is a drawing of a flame.

Preferably, the picture or drawing of the flame is coloured. Any colour or combination of colours can be used.

The transparent portions are designed or shaped to represent the appearance of flames.

The second moveable flame template may comprise of one or more moveable members visible through the diffuser screen.

The apparatus may further include means for moving the moveable members. Typically, the means for moving the moveable members will be a fan adapted to induce a current of air.

The one or more moveable members are preferably flexible and otherwise adapted to flutter in the current of air induced by the fan.

The second moveable flame template preferably comprises of opaque, elongate moveable members which are adapted to flutter under the influence of a fan induced current of air.

The apparatus may be associated with heating means, such as a fan heater.

The light source may be a fluorescent light. Alternatively, other light sources may be used, including LEDs and halogen lights.

Preferably, the diffuser screen is provided with a first etched surface facing the second randomly moveable screen.

Preferably, the second face of the diffuser is reflective.

More preferably, the second face is provided with a printed surface.

Preferably, the printed surface has a dark colour printed on or near a first end thereof and a light colour printed on or near a second end thereof.

According to a second aspect of the present invention there is provided a flame effect fire comprising flame simulation apparatus according to the first aspect and a

fuel bed, wherein the flame simulation apparatus is associated with a first light source and the fuel bed is associated with a second light source.

Preferably, the first and second light sources are independently operable from each other.

The first light source may be one or more fluorescent lamps. The second light source may be light emitting diodes or a halogen lamp. Either of the light sources may be coloured.

Preferably, each light source is associated with ventilation and/or cooling means.

Preferably, the flame simulating templates, in use, are so disposed as to not receive direct light from said second light source. For example, preferably a barrier is provided which shields the flame simulation apparatus from light emitted by the second light source, in use.

According to a third aspect of the present invention, there is provided a flame effect fire comprising flame simulation apparatus associated with a first light source, and a fuel bed associated with a second light source.

Preferably, the first and second light sources are independently operable from each other.

The first light source may be one or more fluorescent lamps. The second light source may be light emitting

diodes or a halogen lamp. Either of the light sources may be coloured.

Preferably, each light source is associated with ventilation and/or cooling means.

The flame simulation apparatus may include flame effect templates or reflectors adapted to reflect, refract or diffuse light from the first light source.

Preferably, the flame simulating templates, in use, are so disposed as to not receive direct light from said second light source. For example, preferably a barrier is provided which shields the flame simulation apparatus from light emitted by the second light source, in use.

In order to provide a better understanding of the invention, an embodiment will now be described by way of example only with reference to the accompanying Figures, in which:

Figure 1 is a schematic cross-sectional side elevation of an electric fire in accordance with the present invention;

Figure 2 is a pictorial view of a first flame template;

Figure 3 is a pictorial view of a second moveable flame template as may be incorporated in the embodiment of Figure 1;

Figure 4 is a schematic cross-sectional side elevation of a second embodiment of an electric fire in accordance with the present invention;

Figure 5 is a pictorial view of a first flame template in accordance with the second embodiment of the present invention; and

Figure 6A is side view of the diffuser screen. Figure 6B is the front view of the same diffuser screen as used in the second embodiment of the present invention.

Referring now in more detail to the embodiment of Figure 1, an electric fire is generally depicted as 1. The fire 1 incorporates a flame simulating means which itself comprises a light source 2 adapted to project light through various flame templates to a diffuser screen 5.

As the light source 2 is located rearwardly of the electric fire, it is preferred that the light source be of a long lasting and durable type, such as a fluorescent lamp.

The diffuser screen 5 comprises of a glass or Perspex plate as are common and well known in the art. The diffusion capability of the screen 5 may vary across its surface such that, for example, the flame image apparent on the diffuser screen is more intense toward the lower edge of the screen 5.

As mentioned above, the flame simulating apparatus in the embodiment shown includes flame templates 3, 4. In the

example embodiment flame template 3 comprises of a planer sheet of a rigid transparent material, such as Perspex. The first flame template 3 does however comprise of opaque portions which may be rendered opaque by the application of a paint or other coating to the Perspex material.

It will be understood that in alternative embodiments, the combination of opaque and transparent portions on the first flame template may be achieved by the use of cut out portions within an otherwise opaque sheet. In such an example, the sheets may be made of a metallic material.

Indeed, in various other example embodiments the first flame template 3 may be made of a plastics material of varying transparency and/or translucency, incorporating varying colour and/or tinting across its surface. By this, a diverse range of visual images with various flame shapes, sizes and colours can be achieved using a single white light source.

The flame simulating apparatus further comprises a second flame template 4 which is adapted to move, in operation, in a random and non-repetitive manner. As shown in Figure 3, the second moveable flame template 4 may comprise of several elongate strips of flexible material, such as ribbon or other cloth or textile. These elongate flexible members are vertically disposed in parallel alignment being anchored at each end by rods 14a, 14b.

In operation, the elongate members are acted upon by a fan 6 adapted to induce a current of air. Air blown by

the fan 6 onto the elongate members 13 cause the members 13 to flutter so as to simulate the flickering of a natural flame.

In the present invention, the elongate members 13 or other second moveable flame template 4 are opaque or near opaque and thus adapted to block or shield the diffuser screen 5 from light emitted by the light source 2 through the first flame template 3. Thus, unlike previously known flame simulating apparatus, the elongate members are adapted to shadow or blackout constantly varying shape portions of the simulated flames, rather than represent the flames themselves. Accordingly, as the second moveable flame template represents a dark or shadowed appearance, a viewer's vision is not directed towards the second flame template and particularly its perimeters. It will be understood by the reader that this adds to the realism of the visual appearance.

Thus, a non-repetitive and random visual image simulating a series of flames such as might be produced by a natural fire may be seen projected onto the diffuser screen 5.

With electric fires of this type, it has been found commercially desirable to also include an artificial fuel bed. The example embodiment of Figure 1 illustrates a fuel bed which is depicted by reference numeral 9. The fuel bed 9 may comprise of various known artificial elements, including various composite or plastic materials that are shaped and coloured so as to represent coal, logs or other natural combustible materials.

In accordance with the present invention, a second light source 8 is associated with the fuel bed 9. The second light source 8 may comprise of LEDs which may flicker or be programmed to emit light of varying intensity over time. Alternatively, the light source may comprise of halogen lamps or any other known light source.

As will be understood by those skilled in the art the second light source 8 is disposed in a location whereby it is adapted to illuminate the fuel bed 9 such that the fuel bed appears to glow representing the appearance of heat.

An advantage of the provision of this second light source is that the fuel bed may be illuminated independently of the illumination associated with the flame simulation means. Indeed, there need not be any flame simulation while the fuel bed is illuminated, thus allowing for a mode of operation that does not require the need for the fan 6 to be activated or for the appearance of heat being emitted by the flame simulating apparatus.

The second light source 8 may be housed such that light emitted therefrom may freely reach the fuel bed 9, but yet not directly reach the flame simulating apparatus, including the flame templates 3, 4. This may be achieved, in one embodiment, by the provision of an opaque barrier 11 between the second light source 8 and the flame simulating apparatus. A transparent plate 10 may be used to support the fuel bed 9.

Various vents 7 may be provided to allow for the escape of heat which accumulates from the use of the light

sources 2 and 8. Although a barrier 11 may be provided between the light source 8 and the flame simulating apparatus, it should be noted that it is still possible to allow for the free flow of air between the first light source 2 and the second light source 8 and various light vents 7 associated with the housing for each light source.

A second fan 15 may be employed to assist in the convection of heat emitted from the heating element 12 into the surrounding environment for the primary purpose of heating that environment. In an alternative embodiment, the second fan 15 may also be used to induce a current of air for randomly moving the second flame template 4. Yet further, the second fan 15 may be used to assist in the ventilation of heat resulting from the use of the light sources 2 and 8.

Figure 2 provides an example embodiment of the first flame template 3 as shown in Figure 1. It should be appreciated that many different designs of template may be used and such templates need not be limited to planar designs. Yet further, a series of such templates may be employed whether moveable on a motor or rotating shaft or stationary, or indeed a combination of both.

Figures 4, 5, 6A and 6B relate to a second embodiment of the present invention.

Figure 4 shows an electric fire 100 in accordance with the second embodiment of the present invention. The features of this second embodiment of the present invention are substantially similar to those of the first

embodiment of the present invention except for modifications to the first flame template 103 and to the diffuser screen 105.

In this embodiment of the present invention the first diffuser screen 103, as described in more detail in Figure 5, comprises a screen made of a printable medium 125 in which the picture, drawing or other representation 127 is printed onto the screen. The parts of the printable medium 125 onto which the flame representation 127 has been printed or otherwise embedded are translucent and are coloured to represent a flame. The background of the medium onto which no flame pattern or representation has been printed or etched is substantially opaque, and may be white or another suitable colour. The printable medium could be cloth, ~~paper or other suitable material.~~ The screen can also be reinforced with a more rigid backing material.

The colour of the flame effect is typically orange or red but can also be blue, yellow or any other pre-selected colour.

In addition, the screen 105 is provided with an etched surface 117 (Figure 6A and 6B) which acts to diffuse light transmitted through the diffuser screen from light source 102. Whilst this surface has been etched in this example, other means of diffusing the light through the diffuser screen can be used, for example by the use of a translucent diffusing tape or the like.

The diffusing screen 105 is also provided with a reflecting surface 119 (Figure 6A and 6B) that faces

outwards from the body of the fire 100 and which is intended to reflect light outwards incident on the front face of the fire. In this embodiment of the present invention, the diffuser screen 105 is also provided with a screen printed surface which can be provided in a range of colours. In this example the surface is printed with a light colour or no colour towards the position of the fuel effect 109, this allows a greater amount of light to be reflected from behind the fuel effect 109 to provide greater authenticity. The printed screen is darkened towards the top of the screen so that less light is reflected from the surface of the diffuser towards the top, this also enhances the flame effect produced by the screens. This feature is illustrated in Figure 6B in which the position of the lighter colours or planes reflective coating is shown by reference numeral 121 and ~~the position of the dark printed colour~~ by reference numeral 123.

Further modifications and improvements may be incorporated herein without departing from the scope of the invention.

CLAIMS

1. Apparatus for producing a non-repeat or random flame effect comprising a light source emitting light beams and a diffuser screen through which the light beams are viewed, wherein a first flame template and a second randomly moveable flame template are disposed between the light source and the diffuser screen.
2. Apparatus as claimed in Claim 1 wherein the first flame template is stationary with respect to the light source.
3. Apparatus as claimed in Claim 1 or Claim 2 wherein the first flame template is a generally planar sheet material comprising of opaque portions and transparent portions.
4. Apparatus as claimed in Claim 1 or Claim 2 wherein the first flame template is a generally planar sheet material comprising of an opaque material with cut-out portions.
5. Apparatus as claimed in any preceding Claim wherein the first flame template is arranged to provide the appearance of flames.
6. Apparatus as claimed in Claim 3 wherein the transparent portions is a still photograph of a flame.
7. Apparatus as claimed in any preceding Claim wherein the second randomly moveable flame template comprises

- one or more moveable members visible through the diffuser screen.
8. Apparatus as claimed in Claim 7 wherein the one or more moveable members are flexible.
 9. Apparatus as claimed in Claim 7 or Claim 8 wherein the one or more moveable members are opaque and elongate.
 10. Apparatus as claimed in any one of Claims 7 to 9 wherein the apparatus further includes means for moving the moveable members.
 11. Apparatus as claimed in Claim 10 wherein the means for moving the moveable members is a fan adapted to induce a current of air so as to cause the moveable members to flutter.
 12. Apparatus as claimed in any preceding Claim wherein the apparatus is associated with heating means.
 13. Apparatus as claimed in Claim 12 wherein the heating means is a fan heater.
 14. Apparatus as claimed in any preceding Claim wherein the light source is a fluorescent light.
 15. Apparatus as claimed in any preceding Claim wherein the diffuser screen includes a first etched surface facing the second randomly moveable flame template.

16. Apparatus as claimed in Claim 15 wherein a second face of the diffuser screen, opposite the first face, is reflective.
17. Apparatus as claimed in Claim 16 wherein the second face is provided with a printed surface.
18. Apparatus as claimed in Claim 17 wherein the printed surface has a dark colour printed on or near a first end thereof and a light colour printed on or near a second end thereof.
19. A flame effect fire comprising flame simulation apparatus as claimed in any one of Claims 1 to 18 and a fuel bed, wherein the flame simulation apparatus is associated with a first light source and the fuel bed is associated with a second light source.
20. A flame effect fire as claimed in Claim 19 wherein the first and second light sources are independently operable from each other.
21. A flame effect fire as claimed in Claim 19 or Claim 20 wherein the second light source is one or more light emitting diodes.
22. A flame effect fire as claimed in Claim 19 or Claim 20 wherein the second light source is a halogen lamp.
23. A flame effect fire as claimed in any one of Claims 19 to 22 wherein each light source is associated with cooling means.

24. A flame effect fire as claimed in any one of Claims 19 to 23 wherein the fire further comprises a barrier arranged to shield the flame simulation apparatus from light emitted by the second light source.
25. A flame effect fire comprising flame simulation apparatus associated with a first light source, and a fuel bed associated with a second light source.
26. A flame effect fire as claimed in Claim 25 wherein the first and second light sources are independently operable from each other.
27. A flame effect fire as claimed in Claim 25 or Claim 26 wherein the first light source is one or more fluorescent lamps.
28. A flame effect fire as claimed in any one of Claims 25 to 27 wherein the second light source comprises one or more light emitting diodes.
29. A flame effect fire as claimed in any one of Claims 25 to 27 wherein the second light source comprises a halogen lamp.
30. A flame effect fire as claimed in any one of Claims 25 to 29 wherein either of the light sources is coloured.
31. A flame effect fire as claimed in any one of Claims 25 to 30 wherein each light source is associated with cooling means.

32. A flame effect fire as claimed in any one of Claims 25 to 31 wherein the flame simulation apparatus includes flame effect templates adapted to reflect, refract or diffuse light from the first light source.
33. A flame effect fire as claimed in any one of Claims 25 to 32 wherein the flame simulation apparatus includes reflectors adapted to reflect, refract or diffuse light from the first light source.
34. A flame effect fire as claimed in any one of Claims 25 to 33 wherein the fire further comprises a barrier arranged to shield the flame simulation apparatus from light emitted by the second light source.

$\frac{1}{4}$

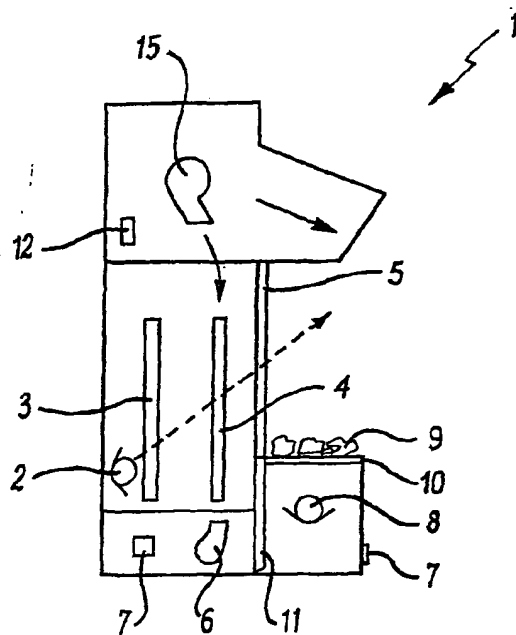
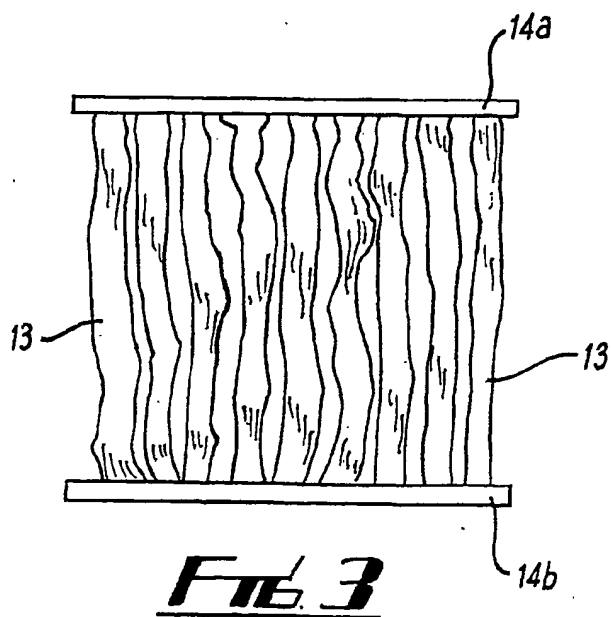
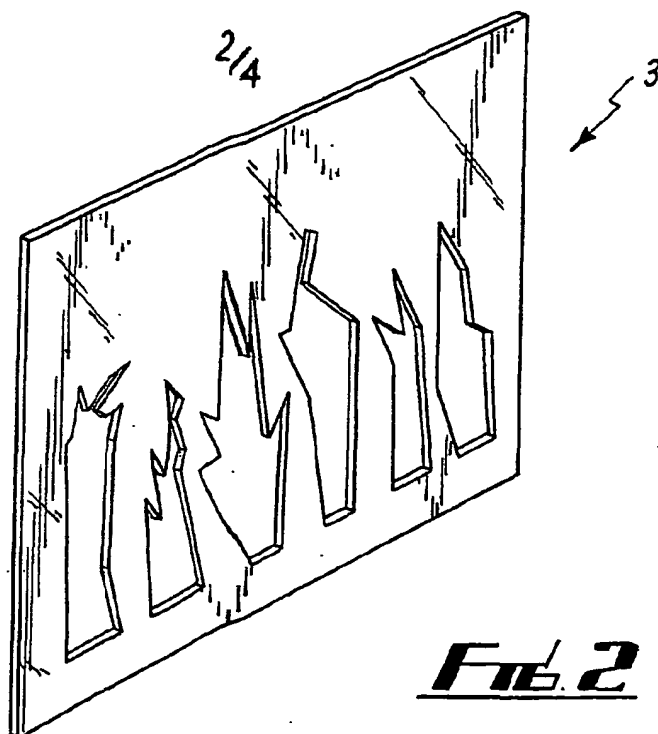


Fig. 1



3/4

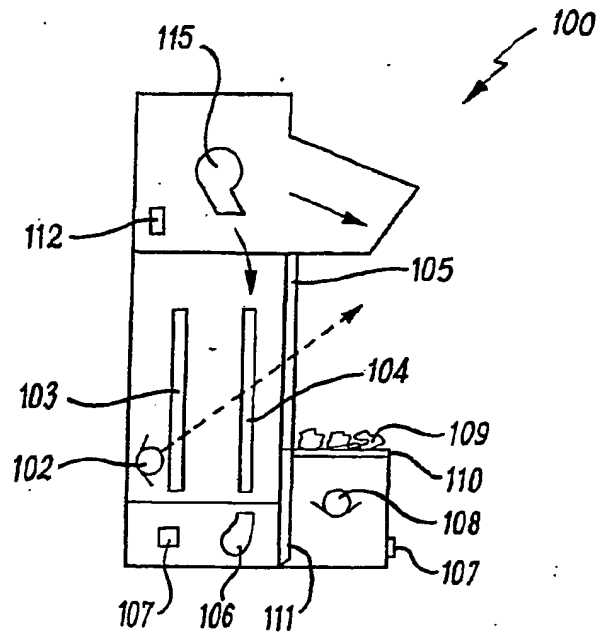
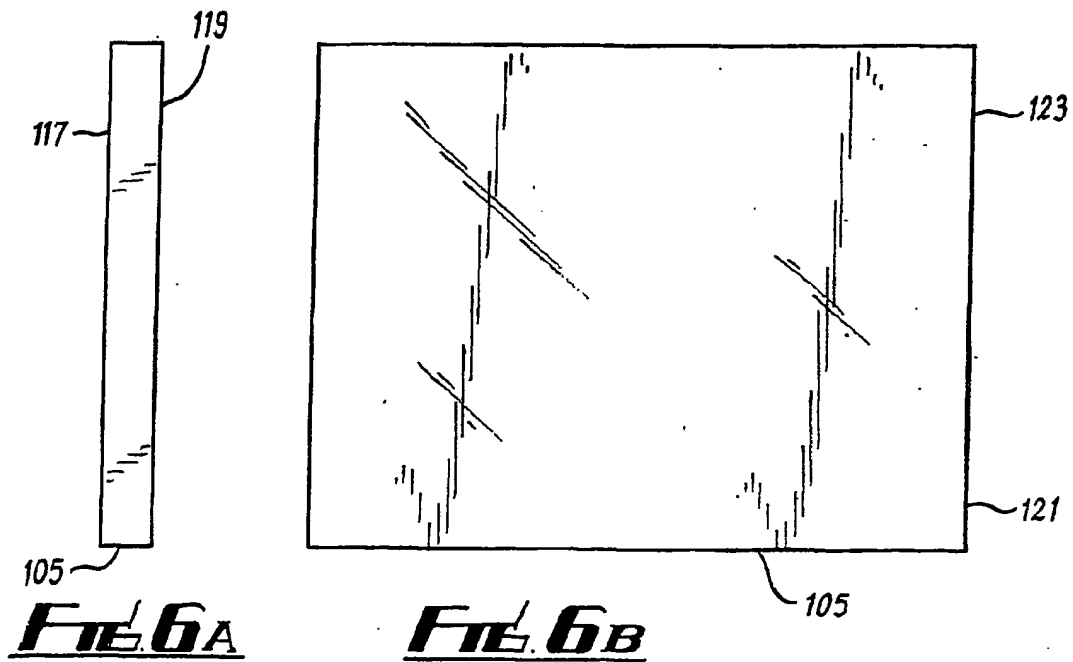
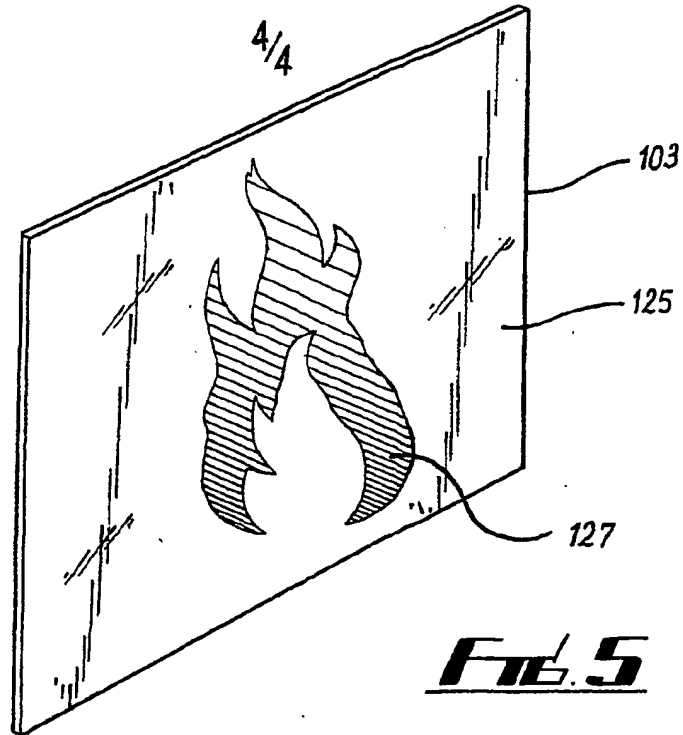


FIG. 4



INTERNATIONAL SEARCH REPORT

PCT/GB2004/004042

A. CLASSIFICATION OF SUBJECT MATTER IPC 7 F24C7/00 F21S10/04		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC 7 F24C F21S		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002/168182 A1 (MARTIN COLM A ET AL) 14 November 2002 (2002-11-14)	1-5,7, 10,12, 13, 15-19, 21,22, 25,26, 28,29,32
Y	paragraphs '0006!, '0008!, '0019!, '0028!, '0031!, '0035!, '0036!, '0038! - '0041!, '0044!; figures	6,8,9, 11,14, 20,23, 24,26, 27,30, 31,33,34
Y	GB 2 377 753 A (* VALOR LIMITED) 22 January 2003 (2003-01-22)	6
A	page 5, lines 8-10; figures 1,2,4,5,7,9 -/-	1-34
<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex.		
* Special categories of cited documents : *A* document defining the general state of the art which is not considered to be of particular relevance *E* earlier document but published on or after the international filing date *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) *O* document referring to an oral disclosure, use, exhibition or other means *P* document published prior to the international filing date but later than the priority date claimed *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. *Z* document member of the same patent family		
Date of the actual completion of the international search 9 February 2005		Date of mailing of the international search report 21/02/2005
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer von Mittelstaedt, A

INTERNATIONAL SEARCH REPORT

PCT/GB2004/004042

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB 2 321 700 A (ROBERT * MCPHERSON) 5 August 1998 (1998-08-05) page 2, line 1 -----	14,27
Y	US 2003/126775 A1 (CORY ARTHUR A ET AL) 10 July 2003 (2003-07-10) -----	8,9,11, 20,24, 26,30,34
A	paragraphs '0018!', '0021! - '0023!; figures -----	7,10,32
Y	WO 02/099338 A (FOCAL POINT FIRES PLC; STOKES, RICHARD; BEGLEY, DOMINIC) 12 December 2002 (2002-12-12) -----	33
A	page 6, paragraphs 1,4; figure 3 page 7, paragraphs 4,5 page 9, paragraph 1 -----	7-11,30
A	GB 2 345 338 A (* WILLIAM WATT & SON CONTRACTS LTD) 5 July 2000 (2000-07-05) page 7, lines 8-15; figures -----	6,17,18
P,A	EP 1 347 243 A (DIMPLEX NORTH AMERICA LIMITED) 24 September 2003 (2003-09-24) paragraph '0030! -----	22,29
Y	US 2002/080601 A1 (MELTZER OTTO WILHELM) 27 June 2002 (2002-06-27) column 1, paragraphs 6,7 -----	23,31
A	US 2003/072565 A1 (RAVNBO-WEST PAUL ET AL) 17 April 2003 (2003-04-17) column 3, paragraph 27 -----	23,31

BEST AVAILABLE COPY

INTERNATIONAL SEARCH REPORT

Information on patent family members

PCT/GB2004/004042

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 2002168182	A1	14-11-2002	US 6393207 B1 AT 263340 T CA 2295459 A1 DE 60009358 D1 EP 1020685 A2	21-05-2002 15-04-2004 14-07-2000 06-05-2004 19-07-2000
GB 2377753	A	22-01-2003	WO 02077533 A1 GB 2389650 A	03-10-2002 17-12-2003
GB 2321700	A	05-08-1998	NONE	
US 2003126775	A1	10-07-2003	US 2002174579 A1 GB 2375820 A	28-11-2002 27-11-2002
WO 02099338	A	12-12-2002	GB 2376292 A CA 2445648 A1 CN 1463346 T EP 1393003 A1 WO 02099338 A1 US 2004114351 A1	11-12-2002 12-12-2002 24-12-2003 03-03-2004 12-12-2002 17-06-2004
GB 2345338	A	05-07-2000	NONE	
EP 1347243	A	24-09-2003	EP 1347243 A1	24-09-2003
US 2002080601	A1	27-06-2002	DE 20021826 U1 EP 1217304 A1	26-04-2001 26-06-2002
US 2003072565	A1	17-04-2003	CA 2406557 A1 GB 2381310 A	05-04-2003 30-04-2003

BEST AVAILABLE COPY